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A corresponding bromide is formed when bromine is added to stannic bis-ethyl. It is an oily body, with an irritating odour. When acted upon by ammonia, an oxide is precipitated, which with acids forms beautiful crystallizable salts, readily soluble in water.

A complete history of these salts, and their decompositions with zinc-ethyl, will possess much interest, and may prove of value in referring to a few simple radicals the numerous complex bodies described by Löwig, &c.

The author is at present engaged on this branch of the inquiry, a detailed account of which he hopes to embody in a communication to the Royal Society, the present paper being intended only as an outline to be hereafter filled in.

In conclusion, the author would remark that a rich harvest can scarcely fail to be reaped, from submitting to the action of zinc-ethyl the metallic compounds of other groups, such as arsenic, bismuth, and antimony.

XIV. "Preliminary Notice of Additional Researches on the Cinchona Alkaloids."—Part III. By W. BIRD HERAPATH, M.D. &c. Communicated by Professor STOKES, Sec. R.S.  
Received June 17, 1858.

Since the author had the honour of presenting to the Royal Society his paper entitled "Researches on the Cinchona Alkaloids," Parts I. and II., he has been much occupied with a continuation of the subject, and he has arrived at important results, which, although in an unfinished state, he hastens to lay before the scientific world, in order to assure himself of the priority of discovery.

Having had occasion to make some experiments upon the rotatory power of the  $\beta$ -quinidin mentioned in the first part of his paper, he arrived at the conclusion that some other feebly dextro-gyrate alkaloid accompanied it, and of a more soluble and less crystallizable character. Consequently, on its further purification by frequent recrystallization from alcohol, the quinidin was obtained perfectly pure; it then had the molecular rotation assigned to it by Pasteur, namely  $250^{\circ} \cdot 75^{\nearrow}$ . Two examinations have given the following elements:—

I. Its solution having been made in rectified spirit of  $\cdot 836$  by boiling,

and crystallized at 62° F., the concentrated solution decanted gave the following elements for Biot's formula :—

e.	δ.	l.	Arc blue violet.	
·02728	·85172	315·8	18°·5 ↗	= 251°·7 ↗

II. Its sulphate, perfectly neutral, and concentrated at 61° F.:—

e.	δ.	l.	Arc.	
·0088441	1·00406	315·8	7° ↗	= 249°·55 ↗

These observations were all made with the naked eye, and the tint of passage was that of the blue-violet petal. When the pink violet, or lilac tint was employed, the arc observed was 20°·25 for No. I. experiment, which with the same elements of calculation gave 274°·093 ↗; and with No. II., the arc 25°·75, which, as before, gave 279°·7 ↗. The slightly dextro-gyrate alkaloid existing as a contamination was quinine; and upon its removal, the β-quinidin had the same solubility in ether as the quinidin of Pasteur. One very peculiar circumstance elicited during this examination, was the fact that the perfectly pure recrystallized quinidin, if made into the neutral sulphate and crystallized by cooling, produces, if made with distilled water at 212° F., a slightly greenish solution, however great the care which might have been taken to remove all the mother-water by washing the crystal on the filter. This green tint deepens considerably during concentration, or by boiling, and at length gives rise to the erroneous impression that some salt of copper is present: in this condition, a tube having a length of 315·8 millims., when filled with the solution, is absolutely impervious to light. It is probable that some molecular change is produced by the action of boiling, even if only for a short time; therefore it was necessary to make a concentrated solution at 120° F., and set in repose for some days at 62° F., by which precaution the solution experienced only a very slight discoloration. When formerly experimenting on β-quinidin, the author obtained an iodo-sulphate very different from that which he has described as indicative of the quinidin of Pasteur: having pursued this inquiry, he is now enabled to state that his former discrepancies arose from the fact that quinidin forms two iodo-sulphates, according to the manner in which it is treated.

1st. When a dilute solution of the acid sulphate of quinidin is

mixed with one-third or one-half its bulk of rectified spirit and raised to  $160^{\circ}$  or  $180^{\circ}$ , then treated with tincture of iodine in small quantities, the red iodo-sulphate is produced, having the characters previously described as indicative of quinidin,—quinine, when similarly treated, invariably producing the optical salt.

The only precaution necessary to be taken in the case of the alkaloid quinidin is to avoid adding an excess of iodine; otherwise an amorphous resinoid substance is deposited which will not crystallize.

2ndly. But when we treat the acid sulphate of quinidin in a concentrated form, diluted with from thirty to forty times its bulk of rectified spirit at a temperature from rather below  $120^{\circ}$  F., with the tincture of iodine, even in greater proportions, an optical salt of quinidin is produced, being the perfect analogue of the quinine salt.

It crystallizes from this strong spirituous solution as acicular long lanceolate prisms, the form of which appears to be a rhomboid having  $30^{\circ}$  for the acute and  $150^{\circ}$  as the obtuse angles; but they are more frequently found with a termination like the blade of an ordinary bleeding-lancet. These prisms have a frequent disposition to hemitropism, but in superposition, so that two plates may be often found *overlying each other in a parallel position*, wholly obstructing light in those portions *where they cover each other*, but transmitting an olive- or yellowish-green tint where separate.

Sometimes the terminal planes are rectangular. This imbricated mode of crystallization is very peculiar; and although the author has made thousands of experiments with quinine, yet he never saw anything similar to it; for this alkaloid invariably crystallizes from *dilute alcoholic* solutions as the  $\alpha$ -prism, obstructing light when the length is perpendicular to the plane of reflected light polarized in a vertical plane,—or from *strong alcoholic* solutions, where the spirit is about two-thirds the bulk, as  $\beta$ -prisms, which obstruct light in the opposite plane, or, as the author has described it, when the planes of their length “lie in a plane parallel to that of the polarized beam with which they are examined.” In the case of quinine, these two sets of prisms never occur together; but if made by separate operations *and then artificially mixed on the same slide*, they present the optical characters of this new quinidin salt, *viz. obstructing light when two long prisms overlies each other in a parallel position*. They are there-

fore  $\alpha$ - and  $\beta$ -prisms crystallizing together from the *same strong* alcoholic solution.

The more frequent form in which this salt shows itself, however, is as the  $\alpha$ -prism, from solutions in which the alcohol is vastly predominant over the water; whereas with quinine,  $\beta$ -prisms always develop themselves under similar circumstances (*vide* 'Proceedings,' vol. vi.). This new quinidin salt has a very great similarity in its optical property to the quinine salt. Its reflected tint is a metallic blue-green, when in liquid or in contact with glass; but after filtering, and when exposed on paper, it has a brownish-olive colour, and loses all appearance of metallic reflexion to the naked eye. Its transmitted tint is, when polarized parallel to its axis, a brownish-yellow green, even in thin plates, but verging to brown in thicker. Its "indicative body" colour is brownish red.

One great peculiarity attends upon this salt; if it be permitted to remain in the acid mother-liquid, it disintegrates by gradual solution, and disappears, whilst, upon the side of the bottle, solid and large crystals slowly form, of a rhombohedral form, or having some of its modifications, the more frequent of which is that with replacement upon the short axis of the rhombohedron by triangular planes. These crystals have a deep sienna-brown colour by transmission, and a dark steel-blue by reflexion, verging on purple; they strongly polarize light, and differ materially from the garnet-red iodo-sulphate previously described, by the greater intensity of their optical properties.

When we attempt to purify the optical thin prisms by recrystallization from alcohol, the same modification appears to be produced; but the crystals are acicular rhombic prisms; the optical characters are the same, however, as those of the rhombohedral form.

The characters, therefore, by which this salt is known from quinine are many.

1st. Its crystallizing as  $\alpha$ -prisms, or as  $\alpha$ - and  $\beta$ -prisms from strong spirituous solutions.

2nd. Its brownish-olive reflected tint as seen by the naked eye.

3rd. Its deeper yellow and brownish-green transmitted tint.

4th. The probable difference in the primary form of the laminated variety, being a very acute prism of a rhombic form, having  $30^\circ$  as the acute, and  $150^\circ$  as the obtuse angles.

5th. The modification which it undergoes by resolution or recrystallization, and the formation of a salt more resembling the garnet-red iodo-sulphate, but having strongly marked differential characters from this beautiful salt, viz. its strong tourmaline powers of absorption and its deeper colour, being nearly a brown-purple, and by its disposition to assume the rhombohedric form.

The author has not yet analysed this salt, but hopes ere long to accomplish this matter and communicate his results to the Royal Society; but he ventures to hope that it will be found to contain 2 atoms sulphuric acid and 3 atoms iodine, like the analogous quinine and cinchonidin salts.

The author has also assured himself that there is an analogous class of salts produced by ethyle-quinine and ethyle-quinidin, but optically distinct from those of quinine and quinidin. He has already produced three salts from ethyle-quinine, having optical characters different from any previously described.



1st. A deep purple-red salt by transmitted light, in thicker plates or aciculæ quite impervious to light. This salt occurs as very slender acicular prisms; it has a brilliant metallic-green reflected tint, but very little double absorption.

2nd. There is a foliaceous salt, having a plate-like form, a deep red or orange-red colour, transmitting an orange-yellow, having only slight optical powers.

3rd. A salt having many of the characters of the new quinidin salt when first produced, viz. the optical characters and the  $\alpha$ -form; but on attempting to recrystallize it, the orange-red plates just described are alone produced.

The only salt yet produced from ethyle-quinidin is one very similar to the red salt described above, but it has only been very partially examined. The iodide ethyle-quinidin is a very beautiful silky salt, less soluble than the iodide ethyle-quinine. The author is not aware that it has yet been described. It is readily made by mixing an alcoholic solution of quinidin with an etherial solution of iodide-ethyle; on repose, the new iodide ethyle-quinidin separates in long, slender, silky aciculæ; and further crops can be repeatedly produced by diluting the original solution with water until precipitation *begins* to follow; on long repose, the iodide crystallizes and may be removed by filtration, and washed with dilute spirit.

*Note.*—In reference to the rotatory power of the cinchona alkaloids, the calculation of the molecular rotation gives an excellent plan of deciding on *the purity* of the alkaloid employed; for if the absolute molecular rotation be obtained precisely identical with those given by other optical chemists, the purity may be inferred as proved. But it is possible for a large quantity of two alkaloids to be present in solution, one dextro-, the other levo-rotate, and in such proportions that the polariscope shall give no indication of the presence of either.

Thus a highly concentrated solution of the acid sulphate of quinine, marking a left-handed rotation of  $57^{\circ}$  , was mixed with rather more than double its bulk of a similar solution of quinidin marking  $24^{\circ}$  . The resultant solution gave no rotation at all, the one effect perfectly neutralizing the other.

In experimenting upon *non-fluorescent* solutions of quinine or quinidin in the polariscope, it was found that these solutions were still possessed of their original molecular rotation upon plane-polarized light, even undiminished, if care were taken not to dilute the fluid when destroying the fluorescence by the soluble chloride, &c., which was always done by adding it in the solid state.

XV. “Sur la Relation entre les Courants induits et le Pouvoir Moteur de l'Electricité.” By Professor CARLO MATTEUCCI of Pisa. Communicated by W. R. GROVE, Esq. Received May 20, 1858.

Dans la 1<sup>ère</sup> partie de ces recherches j'ai étudié l'influence des extra-courants induits sur le fil même de la spirale d'un électro-aimant, sur les propriétés électro-magnétiques et électrolytiques du courant qui met la spirale en action. Cette influence intervient nécessairement dans le jeu des moteurs électro-magnétiques, et la recherche de la corrélation des forces présentée par un de ces moteurs ne pourrait être complète sans pouvoir déterminer rigoureusement la quantité d'action chimique qui a lieu dans la pile. Voici les résultats que j'ai établi par des expériences exactes.

1°. Dans les expériences faites sans avoir les bobines de l'électro-aimant dans le circuit, la force électro-magnétique du courant est